

UNCLASSIFIED

AD NUMBER	
AD007645	
CLASSIFICATION CHANGES	
TO:	unclassified
FROM:	confidential
LIMITATION CHANGES	
TO: Approved for public release; distribution is unlimited.	
FROM: Distribution authorized to DoD only; Test and Evaluation; MAY 1952. Other requests shall be referred to Naval Surface Warfare Center, Indian Head, MD 20640-5035. Pre-dates formal DoD distribution statements. Treat as DoD only.	
AUTHORITY	
NSWC notice dtd 14 Aug 1974; NSWC notice dtd 14 Aug 1974	

THIS PAGE IS UNCLASSIFIED

UNCLASSIFIED

AD _____

DEFENSE DOCUMENTATION CENTER

FOR

SCIENTIFIC AND TECHNICAL INFORMATION

CAMERON STATION ALEXANDRIA, VIRGINIA

DOWNGRADED AT 3 YEAR INTERVALS:
DECLASSIFIED AFTER 12 YEARS
DCD DIR 5200.10



UNCLASSIFIED

THIS REPORT HAS BEEN DECLASSIFIED
AND CLEARED FOR PUBLIC RELEASE.

DISTRIBUTION A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION UNLIMITED.

AS IIA FILE COPY

52-234

SECURITY INFORMATION

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

REPORT NO. 957

BOMBS AND ASSOCIATED COMPONENTS

30th Partial Report

BOMB, G. P. 250 LB. LOW DRAG EX 2 MOD 0
AND BOMB, G. P. 250 LB. AN-M57A1
FRAGMENTATION TEST OF

FINAL Report

Task

Assignment NPG-Re3c-321-1-52

Copy No. 30

Classification CONFIDENTIAL
SECURITY INFORMATION

This report is transmitted for your information and ~~file~~
Additional information may be obtained by addressing:

Chief, Washington USAF Engineering Field Office
Room 4949, Main Navy Building
Washington 25, D. C.

The telephone extension is 62471 or 65568 on the
~~Department~~ of Defense Exchange.

Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
 Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

PART ASYNOPSIS

1. This test was conducted to determine the fragmentation characteristics of the 250 lb. G.P., Low Drag EX 2 Mod 0, and the 250 lb. G.P. Standard AN-M57A1 bombs, both being 80/20 Tritonal loaded.

2. a. The fragmentation characteristics of the two types of 250 lb. bombs are as follows:

	<u>Beam Spray Velocity</u>	<u>No. Hits on Panels Zone 50° to 135°</u>	<u>Blast Pressure NOL Gages at 50'</u>
Low Drag EX 2 Mod 0 80/20 Tritonal Loaded	5200 ft./sec.	92	8.0 psi
Standard G.P. Bomb AN-M57A1 80/20 Tritonal Loaded	5850 ft./sec.	118	9.3 psi

b. The superiority in fragment velocity and number of fragment hits of the standard G.P. bomb over the Low Drag bomb can be attributed to the differences in explosive weight, wall thickness, and outside diameters, which were as follows:

	<u>Low Drag EX 2 Mod 0</u>	<u>Standard AN-M57A1</u>
Explosive weight (lbs)	103	130
Wall thickness (inches)	0.313	0.270
Outside diameter (inches)	9.0	10.9

Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
 Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

TABLE OF CONTENTS

	<u>Page</u>
SYNOPSIS	1
TABLE OF CONTENTS.	2
AUTHORITY.	3
REFERENCES	3
BACKGROUND	3
OBJECT OF TEST	3
PERIOD OF TEST	3
REPRESENTATIVES PRESENT.	4
DESCRIPTION OF ITEM UNDER TEST	4
DESCRIPTION OF TEST EQUIPMENT.	5
PROCEDURE.	6
RESULTS AND DUSCUSSION	7
CONCLUSIONS.	9
APPENDIX A - BOMB DRAWING, LOW DRAG.	FIGURE 1
APPENDIX B - SPACE DISTRIBUTION DATA	TABLES I-II (Incl)
APPENDIX C - FRAGMENT VELOCITY DATA.	TABLE III 1-5 (Incl) TABLE IV 1-4 (Incl)
APPENDIX D - MASS DISTRIBUTION DATA.	FIGURES 2-3 (Incl) TABLE V 1 (Only)
APPENDIX E - BLAST DATA.	TABLE VI 1 (Only) FIGURES 4-5 (Incl)
APPENDIX F - DISTRIBUTION.	1-2 (Incl)

CONFIDENTIAL

NPG REPORT NO. 957

Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

PART B

INTRODUCTION

1. AUTHORITY:

This test was authorized by references (a) and (b), and conducted under Task Assignment NPG-Re3c-321-1-52, reference (c).

2. REFERENCES:

- a. BUORD Conf ltr Re3c-REN:fml/F41-6 Ser 16771 of 6 Feb 1951
- b. BUORD Conf ltr Re3c-REN:fml/F41-6 Ser 17791 of 5 Mar 1951
- c. BUORD Conf ltr NPG-Re3c-BEK:fml Ser 27779 of 18 Sep 1951
- d. NPG Conf Report No. 833 of 18 Aug 1951
- e. NPG Conf Report No. 878 of 20 Oct 1951

3. BACKGROUND:

In the general development of low drag bombs for aircraft, and specifically to determine the plate penetration and fragmentation characteristics, reference (c) established the task of testing streamlined bomb cases. Reference (d) reported the fragmentation characteristics of the 1000 lb. G.P. and Low Drag Bombs. Reference (e) reported the plate penetration characteristics of the 250 lb. low drag bombs and their fragmentation characteristics are reported herein.

4. OBJECT OF TEST:

This test was conducted to determine the fragmentation characteristics of the 250 lb. G.P., Low Drag EX 2 Mod 0, and the 250 lb. G.P. Standard AN-M57A1 bombs, both being 80/20 Tritonal loaded.

5. PERIOD OF TEST:

- | | |
|---|-----------------|
| a. Dates Project Letters | 6 February 1951 |
| | 5 March 1951 |
| b. Date All Necessary Material Received | 17 July 1951 |
| c. Date Commenced Test | 7 July 1951 |
| d. Date Completed Test | 8 August 1951 |

CONFIDENTIAL
SECURITY INFORMATION

CONFIDENTIAL

NPG REPORT NO. 957

Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

6. REPRESENTATIVES PRESENT:

This test was witnessed in part by Mr. A. S. Will representing the Naval Ordnance Laboratory and Mr. D. K. Tower representing the Daystrom Electric Corporation.

PART C

DETAILS OF TEST

7. DESCRIPTION OF ITEM UNDER TEST:

a. Standard AN-M57A1 250 lb. G.P. Bomb:

10 1/2" diameter, 45.4 length, 0.27 wall thickness, 130 lbs. charge weight, 80/20 Tritonal loaded to density of 1.67, and assembled with AN-M103A1 nose fuze modified for static detonation.

b. 250 lb. G.P. Low Drag EX 2 Mod 0:

9 1/2" diameter, 49 1/2" length, 0.313 wall thickness, 103 lb. charge weight, 80/20 Tritonal loaded to density of 1.67. A photograph of this bomb is shown in Figure 1. The athwartships fuze EX 200 Mod 3 was modified for static detonation and contained the 50% booster size. This booster was 2 1/2" in diameter, 8 1/2" high, and weighed 105.5 grams.

CONFIDENTIAL

NPG REPORT NO. 957

Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

c. The assembly and weights of the fuzes and bombs were as follows:

Rd. No.	Bomb Serial No.	Bomb Type	Empty Wt. (lbs)	Bomb Data		
				Hot Melt (lbs)	Charge Wt. (lbs)	Total Wt. (lbs)
1	--	Low Drag	148	1.0	103.5	252.5
2	--	Low Drag	148	1.0	103.5	252.5
3	--	Low Drag	149	1.0	103	253
4	--	Low Drag	149.5	1.0	103	253.5
5	--	Low Drag	149	1.0	103	253
1	1	Std.	116	--	134	250
2	3	Std.	118	--	131	249
3	2	Std.	117	--	132	249
4	6	Std.	121	--	133	253
5	4	Std.	117	--	132	249

8. DESCRIPTION OF TEST EQUIPMENT:

- a. Five Rochelle Salt velocity gages
- b. Two Tourmaline gages
- c. Three Naval Ordnance Laboratory indenter gages
- d. One 35mm Fastax Camera
- e. Velocity plates, 5' high at 60 feet in polar zone 55°-125°
- f. Two cane fiberboard packs, 4' high, 8' wide in zones 80°-85° and 90°-95°

CONFIDENTIAL
SECURITY INFORMATION

Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

9. PROCEDURE:

a. Five Rochelle Salt velocity gages were mounted in shock mounts on tripods approximately 4 feet from the ground and at approximately 10 foot intervals along a radial line 45° from the beam spray of the detonation, with the nearest at 50 feet from the bomb.

b. Two tourmaline gages were mounted side on to the blast with a 10 foot interval between them along a radial line 42° from the beam spray. The first gage was 50 feet from the bomb.

c. Three Naval Ordnance Laboratory indenter gages were placed beside the Rochelle Salt gage at 50 feet from the bomb. The positions of all the different gages in relation to the bomb and arena are shown in Figure 4.

d. The 35mm Fastax Camera was placed to record fragment hits on 5' high velocity plates which were at 60 feet from the bomb and covered the polar angle zone 55°-125°.

e. Sample beam spray fragments from each round were trapped in 4 foot high cane fiberboard panels located in the polar angle zones 80° to 85° and 90° to 95° on the port side of the bomb at a distance of 60 feet.

f. Bomb position:

Each bomb was placed on a stand in a horizontal position with the nose pointed toward 0° and the base toward 180° in a 60' radius semi-circular arena made up of 1/8" mild steel panels 5' high located on the starboard side of the bomb (0° to 180°).

g. Fuze and Booster positions:

The standard AN-M57A1, 250 lb. G.P. bomb contained a nose fuze modified for static detonation. Fuze and booster positions for the EX 2 Mod 0, 250 lb. G.P. Low Drag bomb, looking at the nose from 0° with the semi-circular arena on the bomb's starboard side:

Round 1, Position 1. Fuze cavity in horizontal plane with booster end at 9 o'clock.

Round 2, Position 2. Fuze cavity in plane 45° from the horizontal plane with booster end at 7:30 o'clock.

Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
 Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

Round 3, Position 3. Fuze cavity in vertical plane with
 booster end at 6 o'clock.

Round 4, Position 4. Fuze cavity in plane 45° from the
 horizontal plane with the booster
 end at 4:30 o'clock.

Round 5, Position 5. Fuze cavity in horizontal plane with
 booster end at 3 o'clock.

10. RESULTS AND DISCUSSION:

a. Fragment Space Distribution:

Space distribution data are shown in Tables I and II. It should be noted that as the booster position of the EX 2 Mod 0, Low Drag bomb is rotated progressively from position 1 to position 5, there is a marked increase in the number of fragment hits on the arena panels. The number of fragment hits on the panels for the low drag bombs were "weighted" by giving double weight to data recorded on Rds. 2, 3, and 4 and single weight to data on Rds. 1 and 5 for a weighted average per round in order to compensate for fuze orientation with respect to the arena panels. The double beam spray previously noted in reference (d) in connection with athwartships fuze bombs was also noted in the space distribution data for the low drag bomb. Results shown in Table I indicate that the beam sprays for the EX 2 Mod 0 low drag bomb are from 60° to 90° and 95° to 125° with the greatest concentration in the zones from 70° to 90° and 95° to 115°. The 5 round average of fragment hits on the arena panels from 50° to 135° are as follows:

<u>Bomb</u>		<u>Filler</u>	<u>Average No. Hits on Panels 50° to 135°</u>
Low Drag	EX 2 Mod 0	80/20 Tritonal	* 92
Standard	AN-M57A1	80/20 Tritonal	118

* Weighted average. Approximately 26% more fragment hits were recorded on the standard G.P. bomb.

Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
 Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

b. Fragment Velocity:

The fragment velocity data measured over a 60' distance of travel for each round of both types of bomb are listed in Tables III and IV and are averaged and summarized as follows:

<u>Bomb</u>		<u>No. Rounds Recorded</u>	<u>Median Fragment Velocities Zone 55°-125° (ft./sec.)</u>
Low Drag	EX 2 Mod 0	5	5200
Standard	AN-M57A1	4	5850

The beam spray fragment velocities of the standard G.P. bombs were approximately 12% higher than those of the Low Drag bombs.

c. Fragment Mass Distribution:

Fragment mass distribution data for both types of bomb are listed in Table V. Photographs of the recovered fragments are shown in Figures 2 and 3. Average results are tabulated for the polar zone 80° to 85° and 90° to 95°. Inasmuch as the beam spray angles and the angle of greatest fragment concentration are different for the two types of bombs tested, the mass distribution data obtained do not present a complete picture of the actual beam spray mass distribution.

d. Blast Data:

The detailed blast pressures obtained from the gages are listed in Table VI and sketches of the set up and typical blast curve are shown in Figures 4 and 5. The average blast pressures are summarized as follows:

<u>Bomb Type</u>		<u>Pressure, NOL Gages at 50' (psi). 5 Round Averages</u>
Low Drag	EX 2 Mod 0	8.0
Standard	AN-M57A1	9.3

CONFIDENTIAL

NPG REPORT NO. 957

Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

PART D

CONCLUSIONS

11. a. The fragmentation characteristics of the two types of 250 lb. bombs are as follows:

	<u>Beam Spray Velocity</u>	<u>No. Hits on Panels Zone 50° to 135°</u>	<u>Blast Pressure NOL Gages at 50'</u>
Low Drag EX 2 Mod 0 80/20 Tritonal Loaded	5200 ft./sec.	92	8.0 psi
Standard G.P. Bomb AN-M57A1 80/20 Tritonal Loaded	5850 ft./sec.	118	9.3 psi

b. The superiority in fragment velocity and number of fragment hits of the standard G.P. bomb over the Low Drag bomb can be attributed to the differences in explosive weight, wall thickness, and outside diameters, which were as follows:

	<u>Low Drag EX 2 Mod 0</u>	<u>Standard AN-M57A1</u>
Explosive weight (lbs)	103	130
Wall thickness (inches)	0.313	0.270
Outside diameter (inches)	9.0	10.9

CONFIDENTIAL
SECURITY INFORMATION

CONFIDENTIAL

NPG REPORT NO. 957


Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

The tests upon which this report is based were conducted by:
M. BERGER, Lieutenant, USN, Fragmentation Firing Officer,
Terminal Ballistics Department

This report was prepared by:
A. N. HUGHES, Lieutenant, USN, Fragmentation Firing Officer,
Terminal Ballistics Department
M. C. McFADDEN, JR., Ensign, USN, Fragmentation Firing Officer,
Terminal Ballistics Department

This report was reviewed by:
V. PHILIPCHUK, Fragmentation Battery Officer,
Fragmentation Division,
Terminal Ballistics Department
R. H. LYDDANE, Director of Research,
Terminal Ballistics Department
W. B. ROBERTSON, Lieutenant Commander, USN,
Terminal Ballistics Batteries Officer,
Terminal Ballistics Department
R. T. RUBLE, Lieutenant Commander, USN,
Terminal Ballistics Officer,
Terminal Ballistics Department
C. C. BRAMBLE, Director of Research, Ordnance Group

APPROVED: IRVING T. DUKE
Rear Admiral, USN
Commander, Naval Proving Ground


C. T. MAURO
Captain, USN
Ordnance Officer
By direction

CONFIDENTIAL
SECURITY INFORMATION

CONFIDENTIAL

NPG REPORT NO. 957

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

Thirtieth Partial Report
on
Bombs and Associated Components

Final Report
on
Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0
and Bomb, G.P. 250 lb. AN-M57A1,
Fragmentation Test of

Project No.: NPG-Re3c-321-1-52
Copy No.: 30
No. of Pages: 10

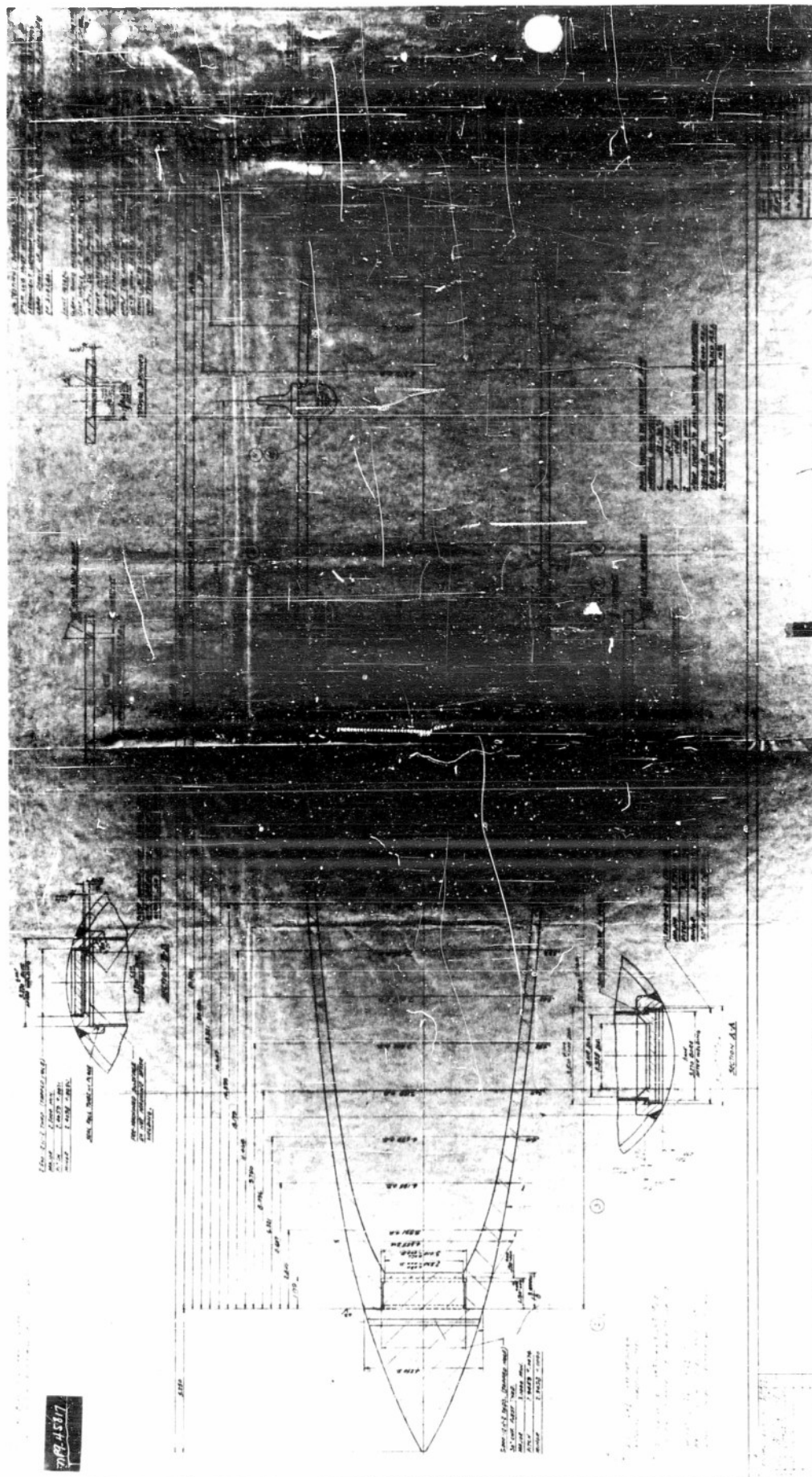
Date: MAY 1 1952

CONFIDENTIAL
SECURITY INFORMATION

6 AUGUST 1951

CONFIDENTIAL
SECURITY INFORMATION

250 lb. Low Drag Bomb EX 2 Mod O.



**BEST
AVAILABLE
COPY**

CONFIDENTIAL

NPG REPORT NO. 957

Bomb, G.P. 250 lb. Low Drag EX 2 Mod C and
 Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

TABLE ISPACE DISTRIBUTION DATA

60' Radius Space Arena

250 lb. Low Drag Bomb EX 2 Mod C

1/8" MS Panels 5' high

80/20 Tritonal Loaded

	<u>Rd.</u> <u>1</u>	<u>Rd.</u> <u>2</u>	<u>Rd.</u> <u>3</u>	<u>Rd.</u> <u>4</u>	<u>Rd.</u> <u>5</u>	<u>Weighed Aver.</u> <u>Impacts per 5°</u> <u>Zone on Panel</u>	<u>Aver. Impacts</u> <u>per total</u> <u>5° Zone</u>	<u>Aver. Impacts</u> <u>per Unit</u> <u>Solid Angle</u>
0-5		2				0.5	1.7	70
5-10	1		1	1		0.6	6	80
10-15	1	1				0.4	6	50
15-20								
20-25		1				0.3	9	40
25-30				1		0.3	10	40
30-35								
35-40								
40-45								
45-50								
50-55	1				1	0.3	18	40
55-60					1	0.1	6	14
60-65	4	2	2	2	3	2.4	160	330
65-70	6	8	4	7	5	6.1	430	840
70-75	6	11	10	12	14	10.8	780	1490
75-80	12	12	14	31	18	18.0	1330	2480
80-85	12	6	10	4	20	9.0	670	1240
85-90	4	13	6	13	18	10.8	810	1490
90-95	3	3	5	8	14	6.1	460	840
95-100	8	9	16	14	18	13.0	971	1790
100-105	6	8	5	7	11	7.1	520	980
105-110	5	3	2	7	6	4.4	320	610
110-115	2	4	2	1	5	2.6	181	360
115-120	1	1	1			0.6	40	80
120-125	1	1				0.4	30	60
125-130					1	0.1	6	14
130-135					1	0.1	6	14
135-140								
140-145	1			1		0.4	18	60
145-150								
150-155								
155-160				1		0.3	9	40
160-165	1	1	4	5		2.6	59	360
165-170	2	3	5	6	6	4.5	73	610
170-175	1	4	3	7	9	4.8	46	650
175-180	16	6	19	19	26	16.3	55	2300

CONFIDENTIAL
 SECURITY INFORMATION

APPENDIX B

Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

TABLE IISPACE DISTRIBUTION DATA

60' Radius Space Arena

Standard G.P. 250 lb. Bomb AN-M57A1

1/8" MS Panels 5' high

80/20 Tritonal Loaded

	Rd. <u>1</u>	Rd. <u>2</u>	Rd. <u>3</u>	Rd. <u>4</u>	Rd. <u>5</u>	Totals	Aver. Impacts Per 5° Zone	Aver. Impacts per total 5° Zone	Aver. Impacts per Unit Solid Angle
0-5	1	5	1	1	1	9	1.8	6	250
5-10				1		1	0.2	2	30
10-15	1			2		3	0.6	10	80
15-20		1				1	0.2	5	30
20-25					1	1	0.2	6	30
25-30					2	2	0.4	13	50
30-35	4	1	2		2	9	1.8	73	250
35-40	2	4		3	3	12	2.4	110	330
40-45		2	1		4	7	1.4	71	193
45-50	6	4	1	1	6	18	3.5	194	480
50-55		2	1	10	2	15	3.0	179	410
55-60	2	3	1	2	6	14	2.8	178	390
60-65	1	2	1	4	1	9	1.8	120	250
65-70	3	1	2	5	4	15	3.0	210	410
70-75	2	4	3	2	7	18	3.5	250	480
75-80	5	2		1	5	13	2.6	191	360
80-85	6	5	5	1	5	22	4.4	330	610
85-90	9	9	2	5	13	38	7.6	570	1050
90-95	11	17	11	16	23	78	15.6	1175	2150
95-100	37	33	20	24	30	144	28.8	2150	3960
100-105	26	20	20	21	10	97	19.4	1428	2670
105-110	2	1	2	4	1	10	2.0	144	280
110-115	1		1	1	1	4	0.8	60	110
115-120	5	6	2	8	4	25	5.0	330	690
120-125	19	10	9	9	9	56	11.2	712	1541
125-130	8	2	4	9	3	26	5.2	310	720
130-135			3	1	1	5	1.0	56	138
135-140		2			1	3	0.6	30	80
140-145	1			2	1	4	0.8	40	110
145-150			2	2		4	0.8	30	110
150-155				6		6	1.2	42	165
155-160	3	2	1			6	1.2	35	165
160-165	4	1	2	2	3	12	2.4	54	330
165-170	3	1	2	1	1	8	1.6	26	220
170-175	1	2	1		1	5	1.0	10	135
175-180		2	1		2	5	1.0	3	141

Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

TABLE III

FRAGMENT VELOCITY DATA

35mm Fastax Camera 2940 frames per sec.
60 foot Radius Arena
Rd. 1 250 lb. Low Drag Bomb, EX 2 Mod 0 80/20 Tritonal Loaded
Fuze: EX 200 Mod 3 with 1/2 size booster
Total Weight 252.5 lbs. Filler Weight 103.5 lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
29	2	6080
31	4	5690
32	5	5510
33	7	5350
34	9	5190
37	1	4770
38	4	4640
41	2	4300
42	3	4200
43	2	4100
44	3	4010
Median		5200
Average		5030

CONFIDENTIAL

NPG REPORT NO. 957

Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
Bomb, G. P. 250 lb. AN-M57A1, Fragmentation Test of

TABLE III (Continued)

35mm Fastax Camera 2790 frames per sec.
60 foot Radius Arena
Rd. 2 250 lb. Low Drag Bomb EX 2 Mod 0 30/20 Tritonal Loaded
Fuze: EX 200 Mod 3 with 1/2 size booster
Total Weight 252 lbs. Filler Weight 103 lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
27	2	6200
28	1	5980
29	6	5770
30	4	5580
31	2	5400
32	6	5230
33	4	5070
34	3	4920
35	6	4780
36	4	4650
37	2	4520
38	4	4410
39	1	4290
40	2	4190
Median		5120
Average		5090

CONFIDENTIAL

NPG REPORT NO. 957

Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

TABLE III (Continued)

35mm Fastax Camera	2850 frames per sec.
60 foot Radius Arena	
Rd. 3 250 lb. Low Drag Bomb EX 2 Mod 0	80/20 Tritonal Loaded
Fuze: EX 200 Mod 3 with 1/2 size booster	
Total Weight 252 lbs.	Filler Weight 103 lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
29	1	5900
30	3	5700
31	7	5520
33	1	5180
35	7	4890
36	3	4750
37	4	4620
38	4	4500
39	6	4380
40	1	4280
41	3	4170
Median		4850
Average		4870

CONFIDENTIAL

NPG REPORT NO. 957

Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

TABLE III (Continued)

35mm Fastax Camera 2850 frames per sec.
60 foot Radius Arena
Rd. 4 250 lb. Low Drag Bomb EX 2 Mod 0 80/20 Tritonal Loaded
Fuze: EX 200 Mod 3 with 1/2 size booster
Total Weight 252 lbs. Filler Weight 103 lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
28	2	6110
29	7	5900
30	7	5700
31	4	5520
32	6	5340
33	8	5180
34	1	5030
35	4	4890
37	3	4620
38	1	4500
41	1	4170
42	2	4070
43	2	3980
Median		5400
Average		5250

CONFIDENTIAL

NPG REPORT NO. 957

Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

TABLE III (Continued)

35mm Fastax Camera	2700 frames per sec.
60 foot Radius Arena	
Rd. 5, 250 lb. Low Drag Bomb EX 2 Mod 0	80/20 Tritonal Loaded
Fuze: EX 200 Mod 3 with 1/2 size booster	
Total Weight 253.8 lbs.	Filler Weight 102.8 lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
25	1	6480
26	3	6230
27	3	6000
28	4	5790
29	8	5590
30	7	5400
31	4	5230
32	3	5060
33	4	4910
34	2	4760
37	2	4380
38	1	4260
39	1	4150
40	2	4050
Median		5450
Average		5320

CONFIDENTIAL

NPG REPORT NO. 957

Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

TABLE IV

FRAGMENT VELOCITY DATA

35mm Fastax Camera 2850 frames per sec.
60 foot Radius Arena
Rd. 1 250 lb. G.P. Bomb AN-M57A1 80/20 Tritonal Loaded
Fuze: AN-M103A1
Total Weight 249 lbs. Filler Weight 131 lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
25	2	6840
26	8	6580
27	7	6330
28	5	6110
29	6	5900
30	2	5700
31	1	5520
32	2	5340
34	1	5030
36	1	4750
37	2	4620
38	1	4500
39	2	4380
41	1	4170
42	2	4070
43	2	3980
45	2	3800
Median		6000
Average		5620

CONFIDENTIAL

NPG REPORT NO. 957

Bomb, G.P. 250 lb. Low Drag EX 2 Mod 0 and
Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

TABLE IV (Continued)

35mm Fastax Camera . 3000 frames per sec.
60 foot Radius Arena
Rd. 2 250 lb. G.P. Bomb AN-M57A1 80/20 Tritonal Loaded
Fuze: AN-M103A1
Total Weight 249 lbs. Filler Weight 132 lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
27	7	6670
28	1	6430
29	5	6210
30	4	6000
31	3	5810
33	2	5450
34	2	5290
35	4	5140
36	1	5000
37	4	4860
39	3	4620
41	1	4390
42	2	4290
43	2	4190
Median		5700
Average		5540

Bomb, G.P. 250 lb. Low Drag EX 2 Mod O and
 Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

TABLE IV (Continued)

35mm Fastax Camera	3000 frames per sec.
60 foot Radius Arena	
Rd. 3 250 lb. G.P. Bomb AN-M57A1	80/20 Tritonal Loaded
Fuze: AN-M103A1	
Total Weight 254 lbs.	Filler Weight 133 lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
26	2	6920
27	2	6670
28	10	6430
29	1	6210
30	5	6000
31	5	5810
32	6	5630
33	5	5450
34	3	5290
35	3	5140
36	4	5000
37	2	4860
38	3	4740
39	1	4620
40	2	4500
41	2	4390
42	2	4290
43	1	4190
Median		5650
Average		5560

CONFIDENTIAL

NPG REPORT NO. 957

Bomb, G.P. 250 lb. Low Drag EX 2 Mod O and
Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

TABLE IV (Continued)

35mm Fastax Camera	2910 frames per sec.
60 foot Radius Arena	
Rd. 4 250 lb. G.P. Bomb AN-M57A1	80/20 Tritonal Loaded
Fuze: AN-M103A1	
Total Weight 249 lbs.	Filler Weight 132 lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
26	5	6720
27	7	6470
28	6	6240
29	4	6020
30	1	5820
31	3	5630
32	1	5460
33	2	5290
34	4	5140
35	2	4990
36	1	4850
37	2	4720
38	1	4590
Median		6050
Average		5860

CONFIDENTIAL
SECURITY INFORMATION

FRAG NO. 1595

NP9 45884

5 RDS 250 LB. LOW DRAG BOMBS. EX 2 MOD 0
80/20 TRITONAL LOADED

		ZONE 80°-85°	ZONE 90°-95°
0 - 5/8	Gms.		
7	Pcs.		9
2.8	Gms.		3.1
5/8 - 1 1/8	Gms.		
11	Pcs.		11
8.2	Gms.		9.7
1 1/4 - 2 1/2	Gms.		
5	Pcs.		14
7	Gms.		25.4
2 1/2 - 5	Gms.		
9	Pcs.		18
31.4	Gms.		63.3
5 - 10	Gms.		
9	Pcs.		18
59.8	Gms.		135.2
10 - 20	Gms.		
16	Pcs.		5
232	Gms.		79.9
20 - 40	Gms.		
3	Pcs.		5
79.3	Gms.		125.1
40 - 80	Gms.		
2	Pcs.		2
90.8	Gms.		86.6
80 - 160	Gms.		
1	Pcs.		
133.4	Gms.		
160 - 320	Gms.		
	Pcs.		
	Gms.		

SCALE 1"

NP9-45884

6 AUGUST 1951

CONFIDENTIAL
SECURITY INFORMATION5 rounds - 250 lb. Low Drag bombs, Ex 2 Mod 0 80/20 Tritonal loaded.
Sample fragments recovered from zones 80°-85° and 90°-95°.
Figure 2

FRA NO 1596

N.P. 9 45890

4 RDS 250 LB. G.P. BOMB AN-M57A1
80/20 TRITONAL LOADED

C- %	Gms.	ZONE 80°-85°	ZONE 90°-95°
5	Pcs.		7
1.4	Gms.		2.5
1/8-1 1/4	Gms.		9
3	Pcs.		7
2.7	Gms.		7
1 1/2-2 1/2	Gms.		11.4
2	Pcs.		6
2.4	Gms.		21.8
2 1/2-5	Gms.		6
1	Pcs.		43.8
2.8	Gms.		4
5-10	Gms.		53.8
4	Pcs.		3
28.8	Gms.		90.2
10-20	Gms.		1
	Pcs.		47.8
	Gms.		
20-40	Gms.		
	Pcs.		
	Gms.		
40-80	Gms.		
	Pcs.		
	Gms.		

SCALE 1"

NP9-45890

31 JULY 1951

CONFIDENTIAL

SECURITY INFORMATION

4 rounds - 250 lb. G.P. Bomb AN-M57A1 80/20 Tritonal loaded. Sample
Fragments recovered in zones 80°-85° and 90°-95°

Figure 3

TABLE V
MASS DISTRIBUTION DATA

Fuze: Nose AN-M103A1 for G.P. AN-M57A1. Fragments recovered from 4' high cane fiberboard
Athwartships EX 200 Mod 3 with 50% packs which were in polar angle zones 90° to 95°
pellet size for Low Drag Bomb EX 2 Mod 0 and 80° to 85° on the port side of the bomb.

Explosive Filler: 80/20 Tritonal for both types of bombs.

Fragmentation of 250 lb. G.P. Low Drag Bomb EX 2 Mod 0 and 250 lb. G.P. Bomb AN-M57A1																									
NUMBER AND WEIGHT OF RECOVERED FRAGMENTS																									
Rds.	Bomb Type	Zone	0-0.625		0.625-1.25		1.25-2.5		2.5-5		5-10		10-20		20-40		40-80		80-160		160-320		Total		Photo. No. NP9
			grams		grams		grams		grams		grams		grams		grams		grams		grams		grams		grams		
			Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	
1-5	Low Drag	80°-85°	2.8	7	8.2	11	7	5	31.4	9	59.8	9	232	16	79.3	3	90.8	2	133.4	1	-	-	644.7	63	45884
1-4	AN-M57A1	80°-85°	1.4	5	2.7	3	2.4	2	2.8	1	28.8	4	-	-	-	-	-	-	-	-	-	-	38.1	15	45890
1-5	Low Drag	90°-95°	3.1	9	9.7	11	25.4	14	63.3	18	135.2	18	79.9	5	125.1	5	86.6	2	-	-	190.3	1	718.6	83	45884
1-4	AN-M57A1	90°-95°	2.5	7	7	9	11.4	7	21.8	6	43.8	6	58.8	4	90.2	3	47.8	1	-	-	-	-	283.3	43	45890
Avg.	Type	Zone																							
"	Low Drag	80°-85°	.6	1.4	1.6	2.2	1.4	1	6.3	1.8	12	1.8	46.4	3.2	15.9	.6	18.2	.4	26.7	.2	-	-	128.9	12.6	-
"	AN-M57A1	80°-85°	.35	1.3	.7	.8	.6	.5	.7	.25	7.2	1	-	-	-	-	-	-	-	-	-	-	9.5	3.8	-
"	Low Drag	90°-95°	.6	1.8	19.4	2.2	5.1	2.8	12.7	3.6	27	3.6	16	1	25	1	17.3	.4	-	-	38.1	.2	143.7	16.6	-
"	AN-M57A1	90°-95°	.6	1.8	1.8	2.3	2.9	1.8	5.5	1.5	11	1.5	14.7	1	22.6	.8	12	.25	-	-	-	-	70.8	10.8	-

CONFIDENTIAL

NPG REPORT NO. 957

Bomb, G.P. 250 lb. Low Drag EX 2 Mod O and
Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

TABLE VI

250 LB. BOMBS. PEAK BLAST PRESSURE (PSI) AT 50 FEET

<u>Bomb Type</u>	<u>Rd. No.</u>	<u>Tourmaline Gages</u>		<u>Rochelle Salt Gages</u>	<u>NOL Indenter Gages</u>
		<u>General Radio</u>	<u>Fairchild</u>	<u>NOL Channel</u>	
Std.	1	---	---		9.6
Std.	2	---	---	11.0	10.0
Std.	3	---	---		9.9
Std.	4	---	---	11.0	9.5
Std.	5	---	---		7.7
Low Drag	1	9.6	10.4		7.9
Low Drag	2	11.0	9.7		7.1
Low Drag	3	11.2	9.9		8.3
Low Drag	4	10.0	10.2	10.8	8.4
Low Drag	5	---	12.6	11.0	8.2

CONFIDENTIAL
SECURITY INFORMATION

APPENDIX E

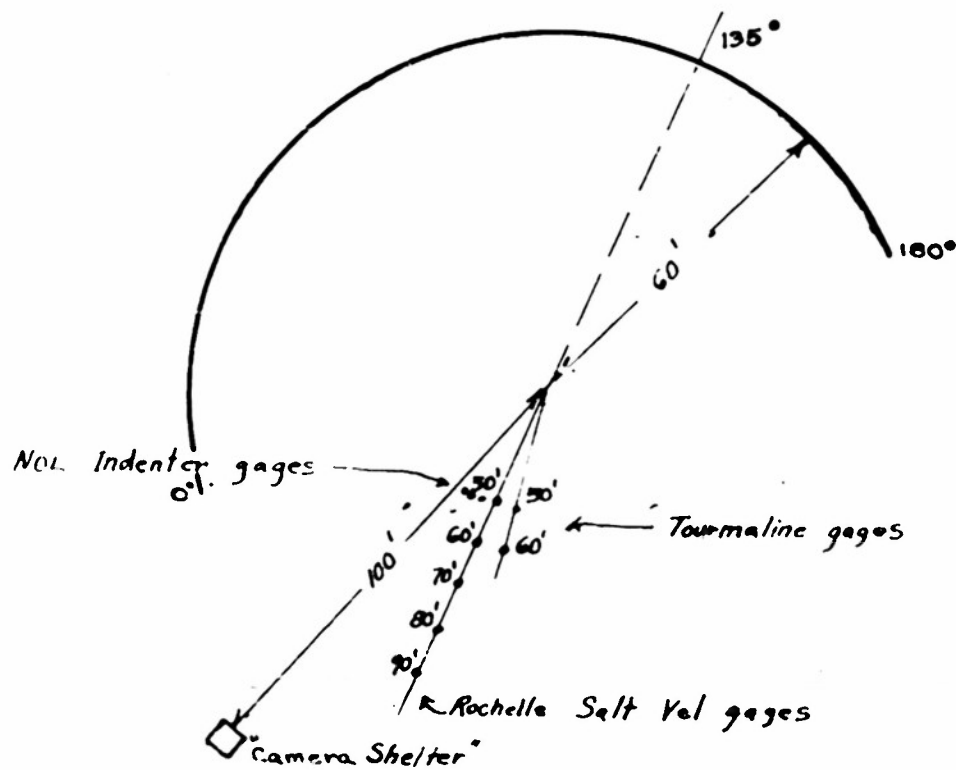
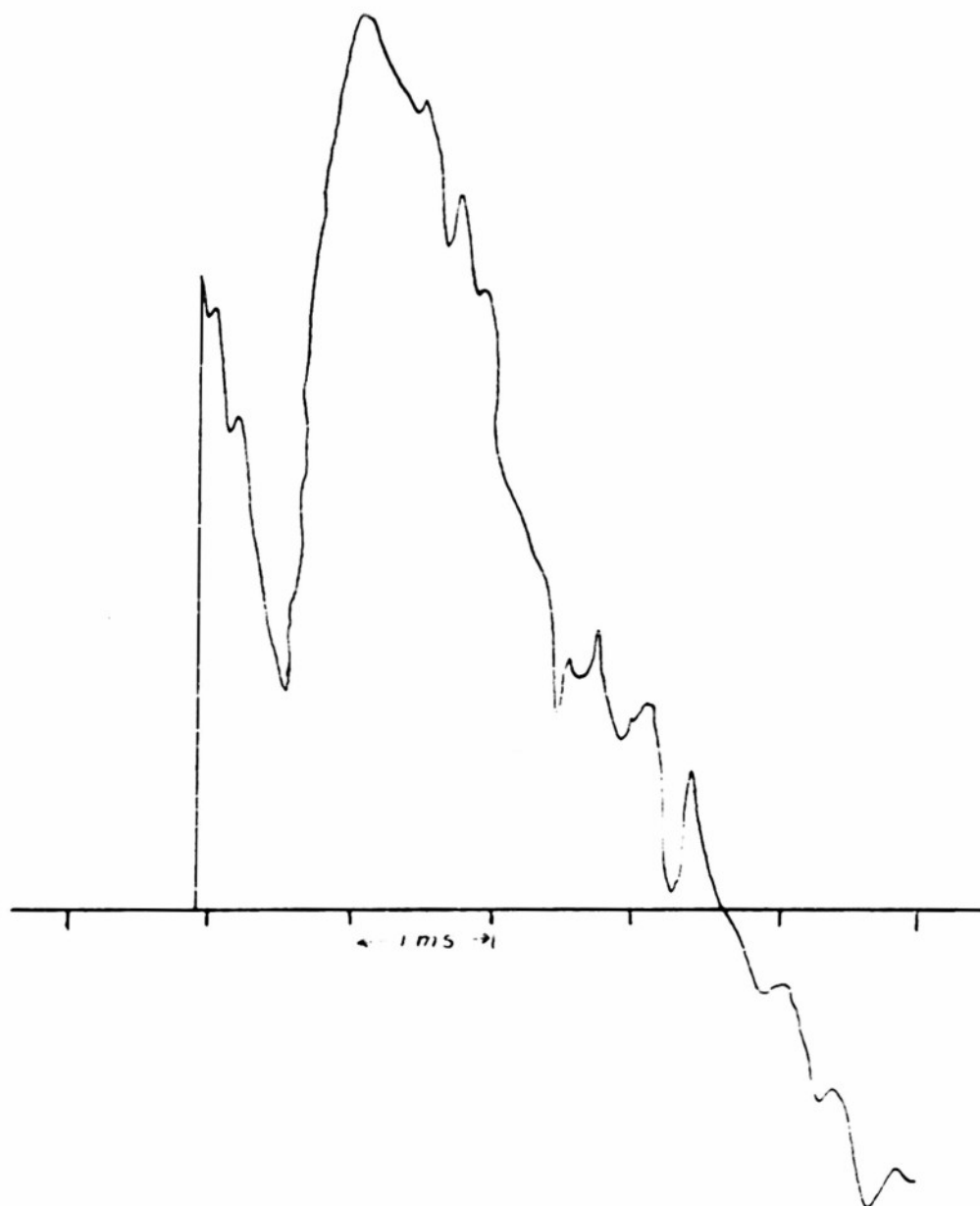


Diagram of test Arena
For 250# Bomb Detonation
7-23-51



250Lb Bomb Detonation #21
As Recorded on the Fairchild
Oscillograph Camera 3/6/51

Bomb, G.P. 250 lb. Low Drag EX 2 Mod O and
Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

DISTRIBUTION

Bureau of Ordnance

Ad3	1
Re2	1
Re3	2
Re2b	2
Re3c	5

Chief of Ordnance, Department of the Army Attn: ORDTX-AR	2
---	---

Navy Research Section, Library of Congress Washington 25, D. C. (Via BUORD Re3)	2
--	---

Commanding General Aberdeen Proving Ground, Aberdeen, Maryland Attn: Technical Information Section Development and Proof Services	1
---	---

Commander, Operational Development Force, U. S. Atlantic Fleet, U. S. Naval Base, Norfolk 11, Virginia	1
--	---

Naval Ordnance Laboratory	1
---------------------------	---

Naval Ordnance Laboratory Attn: Explosives Division	1
--	---

Picatinny Arsenal, Dover, N. J. Attn: Technical Division	1
---	---

Reports Office APL/JHU, Silver Spring, Maryland	1
--	---

Naval Gun Factory Attn: Aircraft Armament Section	1
--	---

NATC, Patuxent River, Md.	3
------------------------------	---

Bomb, G.P. 250 lb. Low Drag EX 2 Mod O and
Bomb, G.P. 250 lb. AN-M57A1, Fragmentation Test of

DISTRIBUTION (Continued)

NAOTS, Chincoteague, Va.	1
Air Materiel Command Liaison Officer Wing 3 Headquarters, Aberdeen Proving Ground Aberdeen, Maryland	2
U. S. Air Force, AMC Engineering Field Office Room 1833, Main Navy Bldg. Navy Department, Washington, D. C.	2
Naval Air Development Center Johnsville, Pa.	1
Bureau of Aeronautics Attn: Armament Section	2
Local: OT	1
OTZ	1
OT-1	1
OML	1
File	1